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Witten Technologies Inc. is developing a non-invasive system for detecting, mapping and inspecting steel and plastic pipelines. The system will combine measurements from ultra-wideband radar and electromagnetic induction arrays with precise positioning and advanced image processing. One component of the system—a radar that can produce 3D underground images up to 20 times faster than previous systems—is already in place and has been tested extensively in projects with major utilities, including several large projects with Consolidated Edison Co. of New York.

The major new work is the development of a novel array of 3-component induction sensors with inversion software to complement the imaging radar system. Ultrawideband radar (in the MHz range) and broadband induction (in the kHz range) should allow accurate mapping of steel and plastic pipelines in nearly all soil types, down to sufficient depths to cover most lines in place in the United States. The dual array will also be useful for mapping large areas to detect leaks.

A 6-channel prototype induction receiver system that records time-domain magnetic fields in the kHz range has been built. The prototype works in conjunction with multiple commercially available clamp-on transmitters that induce currents on buried pipes. Software has been developed to control the data acquisition and processes the data to determine the location of the pipelines. Field tests of the prototype were successful and validated the concept that will be used in the construction of the array induction system.

The design of a 48-channel array induction system has been finalized. The array consists of sixteen 3-component induction sensors and a data acquisition system that is capable of recording the 48 channels simultaneously and resolving signals up to 200 kHz. This system will work (as the 6-channel prototype) in conjunction with multiple commercially available clamp-on transmitters that induce currents on buried pipes. Those components together with an appropriate power supply, survey wheel and counter electronics are assembled on a custom-build trailer for towed deployment behind a vehicle.

The full 48-channel array induction system has been assembled and tested during several smaller test surveys and one large-scale field test using our self-tracking laser positing system at a site that was also surveyed with the radar array system. This is a major milestone for the project as the project moves on from the design and assembly of the hardware into a second phase that is more concerned with testing and improving of the hardware and also more towards data analysis. Extensive field testing will continue.

Software has been developed to control the 48-channel data acquisition and to process the data to determine the location of the pipelines. In addition software solutions have been developed and tested to create utility maps in CAD and GIS environments based on the acquired radar and electromagnetic induction data.

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